CLAIMS

1. In a near-field optical head having a very small aperture for producing or scattering near field light, a near-field optical head characterized by comprising:

a planar substrate formed penetrating through with an inverted conical or pyramidal hole having an apex thereof made as the very small aperture;

an optical waveguide formed on a surface opposite to a surface forming the very small aperture; and

a light reflection film formed in the optical waveguide to bend an optical path.

2. A near field optical head according to claim 1, wherein the optical waveguide is also formed at an inside of the inverted conical or pyramidal hole.

3. A near field optical head according to claim 1 or 2, wherein the inverted conical or pyramidal hole is formed by a plurality of slant surfaces different in slant degree.

4. A near field optical head according to claim 3, wherein in the plurality of slant surfaces a slant surface having a slant degree smaller than a mean slant degree of the plurality of slant surfaces exists in a vicinity of the very small aperture.

5. A near field optical head according to claim 3, wherein in the plurality of slant surfaces at least one slant

surface has an angle of smaller than 55 degrees with respect to the surface forming the very small aperture.

6. A near field optical head according to either one of claim 1 or claim 2, wherein the inverted conical or pyramidal hole has at least one of slant surface in a curved surface form.

7. A near field optical head according to claim 6, wherein, in a vicinity of the very small aperture, at least one of the slant surface in a curved surface form decreases in slant degree as the aperture is approached.

8. A near field optical head according to any one of claim 1 to claim 7, wherein the light reflection film or the optical waveguide has a focusing function to the very small aperture or a light collimating function from the very small aperture.

9. A near field optical head according to any one of claim 1 to claim 8, wherein the optical waveguide is structured by a combination of a clad and a core.

10. A near field optical head according to any one of claim 1 to claim 9, wherein the planar substrate has a plurality of the very small apertures,

the optical waveguide and the light reflection film being formed to guide light generated from at least one of light source to the plurality of very small apertures.

11. In manufacturing a near field optical head having

a planar substrate formed penetrating through with an inverted conical or pyramidal hole having an apex thereof made as the very small aperture;

an optical waveguide formed on a surface opposite to a surface forming the very small aperture; and

a light reflection film formed in the optical waveguide to bend an optical path, a method for manufacturing a near field optical head characterized in that:

the optical waveguide is formed laid on the planar substrate.

12. In manufacturing a near field optical head having

a planar substrate formed penetrating through with an inverted conical or pyramidal hole having an apex thereof made as the very small aperture,

an optical waveguide formed on a surface opposite to a surface forming the very small aperture, and

a light reflection film formed in the optical waveguide to bend an optical path, a method for manufacturing a near field optical head characterized in that:

the optical waveguide is formed bonded on the planar substrate.

13. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex made as the very small aperture;

a process of laying an optical waveguide on a surface opposite to a surface forming the very small aperture;

a process of forming a light reflection film in the optical waveguide in a manner bending an optical path.

14. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex made as the very small aperture;

a process of bonding and forming an optical waveguide on a surface opposite to a surface forming the very small aperture;

a process of forming a light reflection film in the optical waveguide in a manner bending an optical path.

15. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex

made as a first very small aperture; and

a process of forming a light reflection film on a taper of the inverted cone or pyramidal hole, and forming a second very small aperture having a size defined by a thickness of the light reflection film and smaller than the first very small aperture.

16. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex made as a first very small aperture; and

a process of forming a light reflection film having a partly different thickness on a taper of the inverted conical or pyramidal hole, and forming a second very small aperture having a shape defined by the thickness of the light reflection film and different in shape from a shape of the first very small aperture.

17. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex

made as a first very small aperture; and

a process of forming in the planar substrate a light reflection film on a surface including the first very small aperture, and forming a second very small aperture having a size defined by a thickness of the light reflection film and smaller than the first very small aperture.

18. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex made as a first very small aperture; and

a process of forming an oxide film on a surface of the planar substrate including a taper of the inverted conical or pyramidal hole, and forming a second very small aperture having a size defined by a thickness of the oxide film and smaller than the first very small aperture.

19. In a method for manufacturing a near field optical head having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole penetrating through the planar substrate to have an apex made as a first very small aperture; and

a process of performing ion implant to a surface of the planar substrate including a taper of the inverted conical or pyramidal hole, and forming a second very small aperture having a size defined by a thickness expanded due to the ion implant and smaller than the first very small aperture.

20. A near field optical head characterized by comprising:

a planar substrate formed through with an inverted conical or pyramidal hole to have an apex thereof made as a very small aperture;

an optical waveguide laid on an opposite surface of the planar substrate to a surface forming the very small aperture and on an inside of the inverted conical or pyramidal hole; and

a tip sharpened microscopic protrusion formed by one part of the optical waveguide and protruding from the very small aperture of the planar substrate.

21. A near field optical head according to claim 20, wherein in an area except for the protrusion a light reflection layer for reflecting light is formed on a periphery of the optical waveguide.

22. A near field optical head according to claim 20 or claim 21, wherein the protrusion is in an square pyramid form.

23. A near field optical head according to any one of claim 20 to claim 22, wherein the inverted conical or pyramid hole is formed by a plurality of slant surfaces different in

slant degree.

24. A near field optical head according to any one of claims 20 to 23, wherein the optical waveguide is formed by a core and a clad.

25. A near field optical head according to any one of claims 20 to 24, wherein the planar substrate has a plurality of very small apertures, and the optical waveguide and the light reflection layer being formed to guide light emitted from at least one light source toward the plurality of very small apertures.

26. A method for manufacturing a near field optical head characterized by including:

a process of forming an inverted conical or pyramidal hole in a planar substrate;

a process of laying an optical waveguide on the planar substrate including an inside of the inverted conical or pyramidal hole;

a process of forming a microscopic protrusion on an opposite surface of the planar substrate to the inverted conical or pyramidal hole; and

a process of forming a light reflection layer in the optical waveguide in a manner bending an optical path.

27. In manufacturing a near field optical head comprising:

a planar substrate formed through with an inverted

conical or pyramidal hole to have an apex thereof made as a very small aperture;

an optical waveguide laid on an opposite surface of the planar substrate to a surface forming the very small aperture and on an inside of the inverted conical or pyramidal hole;

a tip sharpened microscopic protrusion formed by one part of the optical waveguide and protruding from the very small aperture of the planar substrate, a method for manufacturing a near field optical head characterized in that:

the optical waveguide and the light reflection layer are formed by laying on the planar substrate.

28. In a near field optical head for recording and/or reading-out information of a recording media utilizing near field light, a near field optical head characterized by comprising:

an optical waveguide comprising a first clad formed through with at least one inverted conical or pyramidal hole to have an apex thereof made as a very small aperture, a core formed in a depth direction along a side surface of the inverted conical or pyramidal hole, and a second clad formed in a manner cooperating with the first clad to clamp the core; and

a first reflection film formed on one end surface of the optical waveguide.

29. A near field optical head according to claim 28, comprising a second reflection film formed on an backside of

the first clad and having a microscopic diameter hole in a position corresponding to the very small aperture.

30. A near field optical head according to claim 28 or 29, wherein the one end surface of the optical waveguide is made in a curved surface.

31. In a near field optical head for recording and/or reading-out information of a recording media utilizing near field light, a near field optical head characterized by comprising:

an optical waveguide comprising a clad formed through with at least one inverted conical or pyramidal hole to have an apex thereof made as a very small aperture and a core formed in a depth direction along a side surface of the inverted conical or pyramidal hole;

a reflection film formed on one end surface of the optical waveguide; and

a substrate bonded on the core and having a refractivity different from a refractivity of the core.

32. In a method for manufacturing a near field optical head for recording and/or reading-out information to and from recording medium utilizing near field light, a method for manufacturing a near field optical head characterized by comprising:

a first process of forming a first clad on a substrate;

a second process of forming in the first clad at least

one inverted conical or pyramidal hole such that an apex thereof is made as a very small aperture;

a third process of forming a core in a depth direction along the first clad and the side surface of the inverted conical or pyramidal hole;

a fourth process of forming a second clad in a manner of cooperating with the first clad to clamp the core;

a fifth process of forming a reflection film on one end surface of an optical waveguide formed by the first clad, the core and the second clad; and

a sixth process of removing the substrate.

33. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a near field optical head characterized by comprising:

a very small aperture formed at an apex of a taper formed by an optical propagation member having a tip sharpened toward a recording medium;

a light introducing part for propagating light generally in a parallel direction with the recording medium; and

a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

34. A near field optical head according to claim 33, wherein the taper has at least one part structured by a

combination of a plurality of tapers different in angle of apex spread.

35. A near field optical head according to claim 34, wherein the plurality of tapers has, in a vicinity of the very small aperture, a taper having an angle of spread greater than a mean angle of spread of the plurality of tapers.

36. A near field optical head according to claim 33, wherein the taper has a curved surfaced taper in at least one part thereof.

37. A near field optical head according to claim 36, wherein at least one of the curved surfaced taper increases in angle of spread in the vicinity of the very small aperture as the aperture is approached.

38. A near field optical head according to any one of claim 33 to claim 37, wherein the taper is asymmetric in shape about a center axis of the taper passing the apex.

39. A near field optical head according to claim 33, wherein the light propagation member in at least one part is of dielectric.

40. A near field optical head according to claim 33, wherein the
light propagation member in at least one part is of air.

41. A near field optical head according to claim 33, wherein the
taper in at least one part is covered by metal.

42. A near field optical head according to claim 33, wherein the

taper in at least one part is covered by dielectric.

43. A near field optical head according to claim 42, wherein the

taper in at least one part is covered by dielectric having a refractivity smaller than a refractivity of dielectric constituting the light propagation member.

44. A near field optical head according to claim 33, comprising a protrusion protruded from the very small aperture.

45. A near field optical head according to claim 44, wherein the protrusion in at least one part is dielectric.

46. A near field optical head according to claim 44, wherein the protrusion in at least one part is covered by metal.

47. A near field optical head according to claim 44, wherein the protrusion is in a conical or pyramidal form.

48. A near field optical head according to claim 33, wherein a relative position to the recording medium is kept constant by a floating force undergone from a side of the recording medium and a load weight applied toward the recording medium.

49. A near field optical head according to claim 48, wherein the floating force is an air pressure caused due to high speed motion of the recording medium.

50. A near field optical head according to claim 48, wherein the floating force is due to a pressure of a liquid applied in a constant thickness on a surface of the recording medium.

51. A near field optical head according to claim 33, wherein a relative position to the recording medium is kept constant by controlling an electric interaction caused with the recording medium.

52. A near field optical head according to claim 33, wherein a relative position to the recording medium is kept constant by controlling an interatomic force interaction caused with the recording medium.

53. A near field optical head according to claim 33, having a slider structure in a surface opposed to the recording medium.

54. A near field optical head according to claim 33, wherein the very small aperture is formed in a slider surface.

55. A near field optical head according to claim 54, wherein a spacing between the recording medium and the very small aperture is nearly same as a spacing between the recording medium and the slider surface.

56. A near field optical head according to claim 53, wherein the taper and the slider structure are provided in proximity with.

57. A near field optical head according to claim 53,

wherein the slider structure is arranged in a manner surrounding by 180 degrees over a periphery of the taper.

58. A near field optical head according to claim 53, wherein the slider structure in at least one part is dielectric.

59. A near field optical head according to claim 53, wherein the slider structure in at least one part is metal.

60. A near field optical head according to claim 33, wherein the light reflection layer in at least one part is metal.

61. A near field optical head according to claim 33, wherein the light reflection layer has a focusing function to focus the light reflected toward the very small aperture.

62. A near field optical head according to claim 61, wherein the light reflection layer has a light reflecting surface in a concave surface.

63. A near field optical head according to claim 61, wherein the light reflection layer has a light reflecting surface having a grating structure.

64. A near field optical head according to claim 33, wherein the light reflection layer is formed by working one part of the light introducing part and laying on a worked surface thereof.

65. A near field optical head according to claim 33, wherein the light reflection layer is formed by laying on a

slant surface formed at a constant angle as determined by a planar orientation due to chemical etching.

66. A near field optical head according to claim 65, wherein the slant surface having a constant angle as determined by a planar orientation is in a (111) plane formed in (100) planed single crystal silicon.

67. A near field optical head according to claim 33, wherein the light reflection layer has a reflecting direction of light of approximately 70 degrees with respect to a propagation direction in the light introducing part.

68. A near field optical head according to claim 33, wherein the light introducing part in at least one part is dielectric.

69. A near field optical head according to claim 33, wherein the light introducing part in at least one part is air.

70. A near field optical head according to claim 33, wherein the light introducing part in at least one part is an optical fiber.

71. A near field optical head according to claim 33, wherein the light introducing part in at least one part includes a combination of a core relatively high in refractivity and a clad relatively low in refractivity.

72. A near field optical head according to claim 33, wherein the light introducing part in at least one part has a focusing function to focus light to be propagated to the very

small aperture.

73. A near field optical head according to claim 72, wherein the light introducing part has a vertical surface to a light propagation direction having at least one part made in a convex form.

74. A near field optical head according to claim 72, wherein the light introducing part in at least one part has a grating structure.

75. A near field optical head according to claim 72, wherein the light introducing part in at least one part has a gradient of refractivity having a refractivity different stepwise.

76. A near field optical head according to claim 33, wherein the taper in at least one part is provided with a focus functioning member having a focusing function to focus light to the very small aperture.

77. A near field optical head according to claim 33, wherein a focus functioning member having a focusing function to focus light to the very small aperture is provided in at least one part of an optical path between the light reflection layer and the taper.

78. A near field optical head according to claim 33, wherein a focus functioning member having a focusing function to focus light to the very small aperture is provided in at least one part of the light reflection layer.

79. A near field optical head according to claim 33, wherein a focus functioning member having a focusing function to focus light to the very small aperture is provided in at least one part of the light introducing part.

80. A near field optical head according to any one of claim 76 to claim 79, wherein the focus functioning member in at least one part is dielectric.

81. A near field optical head according to any one of claim 76 to claim 79, wherein the focus functioning member has a vertical surface to a light propagation direction having at least one part made in convex form.

82. A near field optical head according to claim 81, wherein the focus functioning member is spherical.

83. A near field optical head according to any one of claim 76 to claim 79, wherein the focus functioning member in at least one part has a refractive gradient having a refractivity different stepwise.

84. A near field optical head according to any one of claim 76 to claim 79, wherein the focus functioning member in at least one part has a grating structure.

85. A near field optical head according to claim 33, wherein the very small aperture and the light reflection layer are provided in proximity with.

86. A near field optical head according to claim 85, wherein a distance between the very small aperture and the

light reflection layer is 20 μm or less.

87. A near field optical head according to claim 33, wherein an apertured substrate having the very small aperture is provided on a surface opposed to the recording medium.

88. A near field optical head according to claim 87, wherein the light reflection layer is laid and formed on an opposite surface forming the very small aperture of the apertured substrate.

89. A near field optical head according to claim 87, wherein the light reflection layer is bonded and formed on an opposite surface forming the very small aperture of the apertured substrate.

90. A near field optical head according to claim 87, wherein the light reflection layer is laid and formed in a surface forming the very small aperture of the apertured substrate.

91. A near field optical head according to claim 87, wherein the light introducing part is laid and formed on an opposite surface forming the very small aperture of the apertured substrate.

92. A near field optical head according to claim 87, wherein the light introducing part is bonded and formed on an opposite surface forming the very small aperture of the apertured substrate.

93. A near field optical head according to claim 87,

wherein the light introducing part is laid and formed in a surface forming the very small aperture of the apertured substrate.

94. A near field optical head according to claim 87, wherein the light focus functioning member is laid and formed on an opposite surface forming the very small aperture of the apertured substrate.

95. A near field optical head according to claim 87, wherein the light focus functioning member is bonded and formed on an opposite surface forming the very small aperture of the apertured substrate.

96. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and a focus functioning member provided on an optical path between the light reflection layer and the taper and having a convex form in at least one part of a surface vertical to a direction of light propagation, a method for manufacturing a near field optical head characterized in that:

the focus functioning member is formed by working a surface thereof by chemical etching.

97. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and a focus functioning member provided on an optical path between the light reflection layer and the taper and having a convex form in at least one part of a surface vertical to a direction of light propagation, a method for manufacturing a near field optical head characterized in that:

the focus functioning member is formed by exchanging ions from one part of a surface thereof.

98. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and a focus functioning member provided on an optical path between the light reflection layer and the taper and having a refractive gradient having a refractivity different stepwise, a method for manufacturing a near field optical head

characterized in that:

the focus functioning member is formed by exchanging ions from one part of a surface thereof.

99. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and a focus functioning member provided on an optical path between the light reflection layer and the taper and having a convex form in at least one part of a surface vertical to a direction of light propagation, a method for manufacturing a near field optical head characterized in that:

the focus functioning member is formed by setting with UV radiation a liquid having a curved surface due to a surface tension.

100. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and

a focus functioning member provided on an optical path between the light reflection layer and the taper and having a convex form in at least one part of a surface vertical to a direction of light propagation, a method for manufacturing a near field optical head characterized in that:

the focus functioning member is formed by thermosetting a liquid having a curved surface due to a surface tension.

101. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, a method for manufacturing a near field optical head characterized in that:

the taper is formed by conducting surface working using chemical reaction.

102. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and

a metal covering the taper, a method for manufacturing a near field optical head characterized in that:

the very small aperture is formed by plastically deforming the metal in a vicinity of an apex of the taper with using a material harder than the metal.

103. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of a dielectric sharpened at a tip toward the recording medium;

a process of laying a metal film on a periphery of the taper;

a process of working a metal film at a tip of the taper to thereby form a very small aperture;

a process of working an opposite surface forming the very small aperture to thereby form a convex form; and

a process of bonding onto the convex-worked surface a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

104. In a near field optical head for recording and reading-out information by utilizing near field light produced

from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of a dielectric sharpened at a tip toward the recording medium;

a process of laying a metal film on a periphery of the taper;

a process of working a metal film at a tip of the taper to thereby form a very small aperture;

a process of exchanging ions on an opposite surface forming the very small aperture to thereby form a convex form; and

a process of bonding onto the convex-worked surface a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

105. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of a dielectric sharpened at a tip toward the recording medium;

a process of laying a metal film on a periphery of the

taper;

a process of working a metal film at a tip of the taper to thereby form a very small aperture;

a process of exchanging ions on an opposite surface forming the very small aperture to thereby form a convex form; and

a process of bonding onto a surface forming the refractivity gradient a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

106. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of a dielectric sharpened at a tip toward the recording medium;

a process of laying a metal film on a periphery of the taper;

a process of working a metal film at a tip of the taper to thereby form a very small aperture;

a process of applying a liquid over an opposite surface forming the very small aperture and UV-set same to thereby form

a convex form; and

a process of bonding onto a surface formed in the convex form a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

107. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of a dielectric sharpened at a tip toward the recording medium;

a process of laying a metal film on a periphery of the taper;

a process of working a metal film at a tip of the taper to thereby form a very small aperture;

a process of bonding a spherical lens on an opposite surface forming the very small aperture; and

a process of bonding onto a surface of the spherical lens a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

108. In a near field optical head for recording and

reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of air sharpened at a tip toward the recording medium and a first very small aperture at an apex thereof;

a process of laying a metal film on a periphery of the taper to form a second very small aperture;

a process of bonding a dielectric having a surface vertical to a direction of light propagation having a part formed in a convex form onto an opposite surface forming the second very small aperture; and

a process of bonding onto a surface of the dielectric a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

109. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of air sharpened at a tip toward the recording medium and a first very small aperture at an apex thereof;

a process of laying a metal film on a periphery of the

taper to form a second very small aperture;

a process of bonding a dielectric having a refractivity gradient different in refractivity onto an opposite surface forming the second very small aperture; and

a process of bonding onto a surface of the dielectric a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

110. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of air sharpened at a tip toward the recording medium and a first very small aperture at an apex thereof;

a process of laying a metal film on a periphery of the taper to form a second very small aperture;

a process of bonding a spherical lens onto an opposite surface forming the second very small aperture; and

a process of bonding onto a surface of the spherical lens a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

111. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming in a surface opposed to a recording medium a taper of air sharpened at a tip toward the recording medium and a first very small aperture at an apex thereof;

a process of laying a metal film on a periphery of the taper to form a second very small aperture;

a process of applying and UV-set a liquid over an opposite surface forming the second very small aperture to thereby form a convex form; and

a process of bonding onto a surface formed in the convex form a light introducing part for propagating light generally in a direction parallel with a recording medium and a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture.

112. In manufacturing a near field optical head having a very small aperture formed at an apex of a taper formed by a light propagation member sharpened at a tip toward a recording medium, a light introducing part for propagating light generally in a parallel direction with the recording medium, a light reflection layer for reflecting light propagated through the light introducing part toward the very small aperture, and an apertured substrate having a very small aperture on a

surface opposed to the recording medium, a method for manufacturing a near field optical head characterized in that:

the very small aperture, the light introducing part and the light reflection layer are formed by working a material laid on an opposed surface of the apertured substrate to the recording medium.

113. In a near field optical head for recording and reading-out information by utilizing near field light produced from a very small aperture, a method for manufacturing a near field optical head characterized by including:

a process of forming by using chemical reaction a slant surface having a constant angle defined by a planar orientation;

a process of forming a light reflection layer by laying a metal on the slant surface;

a process of forming a light introducing part by laying a dielectric on a top surface of the light reflection layer;

a process of planarize the dielectric layered;

a process of working a part of the dielectric into a taper sharpened toward the recording medium by using chemical reaction;

a process of laying a metal film on a top surface of the taper; and

a process of working the metal film at an apex of the taper to thereby form a very small aperture.

114. A near field optical head according to claim 33, having the very small aperture in plurality of number, and the light introducing part and the light reflection layer being formed to guide light emitted from at least one light source toward a direction of the plurality of very small apertures.

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